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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/395,409	09/14/1999	CHARLES CANTOR	25491-2403D	6005
20985	7590	08/19/2004	EXAMINER	
FISH & RICHARDSON, PC 12390 EL CAMINO REAL SAN DIEGO, CA 92130-2081			CALAMITA, HEATHER	
			ART UNIT	PAPER NUMBER
			1637	
DATE MAILED: 08/19/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/395,409

Applicant(s)

CANTOR ET AL.

Examiner

Heather G. Calamita, Ph.D.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-55,58-60,63-76,88-124 and 127-144 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-55,58-60,63-76,88-124 and 127-144 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Status of Application, Amendments, and/or Claims

1. Amendments of June 21, 2004 have been received and entered in full. Claims 1-55, 58-60, 63-76, 86, 88-124, 127-144 are under examination. Claim 125 has been cancelled. Claims 1, 2, 9, 88, 100, 124 have been amended and claims 129-144 have been added.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-27, 29-33, 35-37, 40-52, 54, 61-62, 64-70, 73-76 are rejected under 35

U.S.C. 102(a) as being anticipated by Köster (WO 94/16101 07/21/1994).

Köster teaches a method for sequencing a target nucleic acid, comprising the steps of:

(see whole document, especially p. 11 lines 27-30)

providing a set of nucleic acid fragments each containing a sequence that corresponds to a sequence of the target nucleic acid;

hybridizing the set to an array of nucleic acid probes to form a target array of nucleic acids, wherein each probe comprises a single-stranded portion comprising a variable region such that each member of the set hybridizes to a member of the array of probes (see p. 14 lines 31-33);

determining molecular weights of nucleic acids in the target array to identify hybridized probes; and based upon the hybridized probes, determining the sequence of the target nucleic acid (see p. 15 lines 2-4). With regard to claim 2, Köster teaches the molecular weights are determined by a method selected from the group consisting of gel electrophoresis, capillary

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electrophoresis, chromatography, and nuclear magnetic resonance (see p. 1 lines 31-33). With regard to claim 3, Köster teaches the molecular weights are determined by mass spectrometry (see p. 11 lines 27-30). With regard to claim 4, Köster teaches the mass spectrometry comprises a step selected from the group consisting of laser heating, droplet release, electrical release, photochemical release, fast atom bombardment, plasma desorption, matrix-assisted laser desorption/ionization, electrospray, and resonance ionization, or a combination thereof (see p. 11 lines 27-30). With regard to claim 5, Köster teaches the mass spectrometry comprises a step selected from the group consisting of Fourier Transform, ion cyclotron resonance, time of flight analysis with reflection, time of flight analysis without reflection, and quadrupole analysis, or a combination thereof (see p. 6 lines 31-33, p. 17 lines 2-5). With regard to claim 6, Köster teaches the mass spectrometry comprises matrix-assisted desorption ionization and time of flight analysis (see p. 17 lines 2-5). With regard to claim 7, Köster teaches the mass spectrometry comprises electrospray ionization and quadrupole analysis (see p. 16 lines 31-33). With regard to claim 8, Köster teaches two or more molecular weights are determined simultaneously (see p. 12 lines 1-3). With regard to claim 9, Köster teaches the step of enzymatically extending the nucleic acid probes of the target array using the hybridized target nucleic acid as a template to form extended strands prior to the step of determining the molecular weights of the nucleic acids (see p. 15 lines 37-39, p. 16 line 1). With regard to claims 10, 51, 52 and 76, Köster teaches the extended strands comprise DNA, RNA, PNA or combinations thereof (see p. 14 lines 35-37). With regard to claims 11 and 48, Köster teaches the step of extending is performed in the presence of chain elongating nucleotides and chain terminating nucleotides (see p. 12 lines 24-29). With regard to claim 12, Köster teaches the array comprises nucleic acid probes having at least one mass-modifying functionality (see p. 15 lines 9-12). With regard to claim 13 and 14, Köster teaches the mass-modifying functionality is coupled to a heterocyclic base, a sugar moiety or a phosphate group (see p. 15 lines 9-12). With regard to claim 15, Köster teaches the mass-modifying

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functionality is coupled to a purine at position C2, N3, N7, or C8 (see Fig 7A). With regard to claim 16, Köster teaches the mass-modifying functionality is coupled to a deazapurine at position N7 or N9 (see Fig 8 A & B). With regard to claim 17, Köster teaches the mass-modifying functionality is coupled to a pyrimidine at position C5 or C6 (see Figs 7A & B). With regard to claim 18, Köster teaches the mass-modifying functionality is selected from the group consisting of F, Cl, Br, I, SiR₃, Si(CH₃)₃, Si(CH₃)₂(C₂H₅), Si(CH₃)(C₂H₅)₂, (CH₂)_nCH₃, (CH₂)_nNR₂, CH₂CONR₂, (CH₂)_nOH, CH₂F, CHF₂, and CF₃; wherein n is an integer; and wherein R is selected from the group consisting of -H, deuterium and alkyls, alkoxys and aryls of 1-6 carbon atoms, polyoxymethylene, monoalkylated polyoxymethylene, polyethylene imine, polyamide, polyester, alkylated silyl, heterooligo/polyaminoacid and polyethylene glycol (see Figs 9 and 10). With regard to claim 19, Köster teaches the mass-modifying functionality is -Na or -XR, wherein X is selected from the group consisting of -O-, -NH-, -NR-, -S-, -OCO(CH₂)_nCOO-, -NHCO(CH₂)_nCOO-, -OSO₂O-, -OCO(CH₂)_n-, -NHC(O)-, and -C(O)NH-, and n is an integer from 1 to 20; and wherein R is selected from the group consisting of -H, deuterium and alkyls, alkoxys and aryls of 1-6 carbon atoms, polyoxymethylene, monoalkylated polyoxymethylene, polyethylene imine, polyamide, polyester, alkylated silyl, heterooligo/polyaminoacid and polyethylene glycol (see Figs 9 & 10). With regard to claims 20-26, Köster teaches X is -NHC(S)-, -NHC(S)NH-, -NC₄O₂H₃S-, -OCO(CH₂)_nS-, -OCO(CH₂)S-, X is -OP(O-alkyl)-, -OPO(O-alkyl)- (see Figs 9 & 10). With regard to claim 27, Köster teaches the mass-modifying functionality is a thiol moiety (see p. 15 lines 7-10). With regard to claim 29, Köster teaches the mass-modifying functionality is an alkyl moiety (see p. 15 lines 7-10). With regard to claim 30, Köster teaches the alkyl moiety is generated by using iodoacetamide (see p. 15 lines 7-10). With regard to claim 31, Köster teaches the step of removing alkali cations (see p. 15 lines 24-27). With regard to claims 32 and 33, Köster teaches the alkali cations are removed by ion exchange (see p. 15 lines 28-29). With regard to claims 35-37, Köster teaches the target nucleic acid is

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provided from a biological sample, and that sample is obtained from a patient, or is provided from a recombinant source (see p. 13 lines 9-24). With regard to claims 43-47, Köster teaches the fragments are provided by enzymatic digestion of the target nucleic acid, the enzymatic digestion is carried out by a nuclease; the nucleic acid fragments are provided by physically cleaving the target nucleic acid the nucleic acid fragments are provided by enzymatic polymerization, wherein the target nucleic acid is a template the enzymatic polymerization is a nucleic acid amplification process selected from the group consisting of strand displacement amplification, ligase chain reaction, Q β replicase amplification, 3SR amplification, and polymerase chain reaction (see p. 13 lines 9-24 and Fig 1). With regard to claim 49, Köster teaches the nucleic acid fragments are provided by synthesizing a complementary copy of the target sequence (see p. 13 lines 18-21). With regard to claim 50, Köster teaches the nucleic acid fragments comprise a nested set (see p. 13 lines 3-4). With regard to claim 54, Köster teaches the probes are single-stranded (see p. 12 lines 32-34). With regard to claims 64, Köster teaches the array of nucleic acid probes is attached to a solid support (see p. 16 lines 13-24). With regard to claims 65, Köster teaches the solid support is selected from the group consisting of plates, beads, microbeads, whiskers, combs, hybridization chips, membranes, single crystals, ceramics, and self-assembling monolayers (see p. 16 lines 13-16). With regard to claim 66, Köster teaches the probes are conjugated with biotin or a biotin derivative and wherein the solid support is conjugated with avidin, streptavidin or a derivative thereof (see p. 15 line 17). With regard to claim 67, Köster teaches each probe is attached to the solid support by a bond selected from the group consisting of a covalent bond, an electrostatic bond, a hydrogen bond, a cleavable bond, a photocleavable bond, a disulfide bond, a peptide bond, a diester bond, a selectively releasable bond and combinations thereof (see p. 15 lines 14-24). With regard to claim 68, Köster teaches the cleavable bond is cleaved by a cleaving agent selected from the group consisting of heat, an enzyme, a chemical agent, and electromagnetic radiation, or a combination thereof (see p. 15 lines 20-24). With regard to claim

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69, Köster teaches the chemical agent is selected from the group consisting of reducing agents, oxidizing agents, and hydrolyzing agents, or a combination thereof (see p. 15 lines 16-17). With regard to claim 70, Köster teaches the electromagnetic radiation is selected from the group consisting of visible radiation, ultraviolet radiation, and infrared radiation (see p. 14 lines 12-15). With regard to claim 73, Köster teaches a spacer between each probe and the solid support (see Fig 23). With regard to claim 74, Köster teaches the spacer is selected from the group consisting of oligopeptides, oligonucleotides, oligopolyamides, oligoethyleneglycerol, oligoacrylamides, and alkyl chains of between about 6 to about 20 carbon atoms, or combinations thereof (see p. 14 lines 31-33). With regard to claim 75, Köster teaches the solid support comprises a matrix that facilitates volatilization of nucleic acids for molecular weight determination (see p. 16 line 31). With regard to claim 127, Köster teaches a system, comprising: a mass spectrometer; a computer; and the array of claim 124 (see p. 11 lines 28-30, and p. 20 lines 33-38).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Köster (WO 94/16101 07/21/1994) in view of Weiss (USPN 6,025,193 02/15/2000).

The teachings of Köster are described previously.

Köster does not teach the generation of a thiol moiety by using Beaucage reagent.

Weiss teaches the generation of a thiol moiety by using Beucage reagent (see col. 19 lines 10-26).

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One of ordinary skill in the art at the time the invention was made would have been motivated to apply Weiss's method of generating a thiol moiety with Köster's method for sequencing nucleic acid by mass spectrometry in order to improve the analysis of the nucleic acids sequences. Weiss states, "By using the sulfurization reagent, each and every "O" group of the phosphodiester bond can be substituted with a sulfur group" (see col. 19 lines 19-21). It would have been prima facie obvious to apply Weiss's method of generating a thiol moiety with Köster's method for sequencing nucleic acid by mass spectrometry to achieve the expected advantage of detecting a sulfurization reagent by which each and every "O" group of the phosphodiester bond can be substituted with a sulfur group.

4. Claims 34, is rejected under 35 U.S.C. 103(a) as being as being unpatentable over Köster (WO 94/16101 07/21/1994) in view of Cantor (USPN 5,503,980 04/02/1996).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). For applications filed on or after November 29, 1999, this rejection might also be overcome by showing that the subject matter of the reference and the

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claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person. See MPEP § 706.02(1)(1) and § 706.02(1)(2).

The teachings of Köster are described previously.

Köster does not teach ligating the hybridized target nucleic acids to the probes.

Cantor teaches ligating the hybridized target nucleic acids to the probes (see col. 8 lines 1-7).

One of ordinary skill in the art at the time the invention was made would have been motivated to apply Cantor's ligation of the probe to the target nucleic acid with Köster's method for sequencing nucleic acid by mass spectrometry in order to improve the fidelity of hybridization. Cantor states, "Ligation of the target nucleic acid to the complementary probe increases fidelity of the hybridization" (col. 8 lines 7-9). It would have been prima facie obvious to apply Cantor's ligation of the probe to the target nucleic acid with Köster's method for sequencing nucleic acid by mass spectrometry to achieve the expected advantage of an improved sequencing method due to the increased fidelity of the hybridization.

5. Claims 71-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Köster (WO 94/16101 07/21/1994) in view of Sanghvi et al. (USPN 6,214,551 04/10/2001).

The teachings of Köster are described previously.

Köster does not teach the selectively releasable bond is 4,4'-dimethoxytrityl or a derivative thereof including 3 or 4 [bis-(4-methoxyphenyl)]-methyl-benzoic acid.

Sanghvi et al. teach the selectively releasable bond is 4,4'-dimethoxytrityl or a derivative thereof (see example 81, col. 58 lines 3-32). Although Sanghvi et al. do not teach the derivative 3 or 4 [bis-(4-methoxyphenyl)]-methyl-benzoic acid in particular, Sanghvi et al. disclose equivalent compounds and derivatives used for the same purpose (Example 81).

One of ordinary skill in the art at the time the invention was made would have been motivated to apply Sanghvi's selectively releasable bond of 4,4'-dimethoxytrityl or a derivative thereof with Köster's method for sequencing nucleic acid by mass spectrometry in order to have a selectively releasable bond. Sanghvi et al. state, "This invention is also directed to methods for the selective binding of RNA for research and diagnostic purposes. Such selective, strong binding is accomplished by interacting such RNA or DNA with compositions of the invention which are resistant to degradative nucleases and which hybridize more strongly and with greater fidelity than known oligonucleotides or oligonucleotide analogs" (col. 31 lines 19-25). It would have been prima facie obvious to apply Sanghvi's selectively releasable bond of 4,4'-dimethoxytrityl or a derivative thereof with Köster's method for sequencing nucleic acid by mass spectrometry to achieve the expected advantage of an invention directed to methods for the selective binding of RNA for research and diagnostic purposes where such selective, strong binding is accomplished by interacting RNA or DNA with compositions of the invention which are resistant to degradative nucleases and which hybridize with greater strength and fidelity than known oligonucleotides or oligonucleotide analogs.

6. Claims 38-39, 53, 55, 86, 88, 89-103-110, 114-124, 128-132, 134, 136-144 are rejected under 35 U.S.C. 103(a) as being unpatentable over Köster (WO 94/16101 07/21/1994) in view of Cantor (USPN 5,503,980 04/02/1996).

The teachings of Köster are described previously.

Köster does not teach probes that comprise a double stranded portion and a single stranded portion. Köster does not teach the probes are about 10 to about 1,000 nucleotides in length. Köster does not teach the variable region is about 4-20 nucleotides in length. Köster does not teach the single stranded region is about 4-20 nucleotides in length. Köster does not teach the fragments of nucleic acids comprise greater than about 104 different members and each member

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is between about 10 to about 1,000 nucleotides in length. Köster does not teach the array comprises a collection of probes with sufficient sequence diversity in the variable regions to hybridize all of the target sequence with complete or nearly complete discrimination.

Cantor teaches probes with a double stranded portion and a single stranded portion, the probes are about 10 to about 1,000 nucleotides in length, the variable region is about 4-20 nucleotides in length, the single stranded region is about 4-20 nucleotides in length (see whole document especially col. 3 lines 32-36, see col. 5 lines 53-59, col. 7 lines 65-67 and col. 8 lines 1-7). Cantor teaches the fragments of nucleic acids comprise greater than about 104 different members and each member is between about 10 to about 1,000 nucleotides in length and the array comprises a collection of probes with sufficient sequence diversity in the variable regions to hybridize all of the target sequence with complete or nearly complete discrimination (see col. 6 lines 1-6).

One of ordinary skill in the art at the time the invention was made would have been motivated to apply Cantor's probes with Köster's method for sequencing nucleic acid by mass spectrometry in order to improve nucleic acid sequencing. Cantor states, "This invention is directed to methods for sequencing nucleic acids by positional hybridization, to procedures combining these methods with more conventional sequencing techniques, to the creation of probes useful for nucleic acid sequencing by positional hybridization, to diagnostic aids useful for screening biological samples for nucleic acid variations, and to methods for using these diagnostic aids" (col. 1 lines 10-16). It would have been prima facie obvious to apply Cantor's probes with Köster's method for sequencing nucleic acid by mass spectrometry to achieve the expected advantage of an improved sequencing method conferring the advantage of accurate high throughput analysis.

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Response to Arguments

7. The amended claims have been entered.

Response to Arguments

8. Applicant's arguments with respect to all pending claims have been considered but are moot in view of the new ground(s) of rejection.


Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather G. Calamita, Ph.D. whose telephone number is 571.272.2876 and whose e-mail address is heather.calamita@uspto.gov. However, the office cannot guarantee security through the e-mail system nor should official papers be transmitted through this route. The examiner can normally be reached on Monday thru Thursday 7:00 A.M. - 5:30 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gary Benzion can be reached on 571.272.0782. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

hgc


JEFFREY FREDMAN
PRIMARY EXAMINER
8/13/09